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SOIL CONSERVATION SERVICE
WASHINGTON 25, D. C.

In Cooperation with the
Agricultural Engineering Department
of the
Virginia Agricultural Experiment Station

# RATES OF RUNOFF IN THE RIDGES AND VALLEYS OF VIRGINIA

*By*

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## FOREWORD

This publication is one of the series based on results from runoff studies and other hydrologic research projects in the several land-resource areas of the United States. It deals specifically with the basic hydrologic phases of soil and water conservation in the Ridges and Valleys of Virginia.

The design values recommended in this report are based primarily on data collected from runoff studies and other research projects of the Soil Conservation Service in cooperation with the Virginia Agricultural Experiment Station. Records from the Virginia Agricultural Experiment Station, Tennessee Valley Authority, United States Forest Service, and several other sources were also utilized in the analysis.

Hydrologic research in Virginia has not been extensive. Consequently, there is a definite need for more information regarding the relation between rates and amounts of runoff from various watershed sizes, cover conditions, and soils. Values presented in this report must be considered tentative and subject to revision as additional information becomes available.

The material in this publication pertains only to peak rates of runoff that may be expected in the Ridges and Valleys region. It is intended, at a later date, to prepare a publication dealing with the hydrologic design of farm ponds and other structures based on amounts of runoff.

An attempt has been made to present all data in such a manner that they may be easily incorporated in field handbooks or manuals.

M. L. Nichols
Chief of Research

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[1] Former staff member.

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# RATES OF RUNOFF IN THE RIDGES AND VALLEYS REGION OF VIRGINIA

By T. W. Edminister, Project Supervisor, Division of Drainage and Water Control, Soil Conservation Service, and J. H. Lillard, Project Leader, Virginia Agricultural Experiment Station.

## INTRODUCTION

At the start of the soil conservation program in the United States, most of the previous hydrologic studies applied to watersheds with extensive areas. To meet the needs for design data for small areas the Soil Conservation Service cooperating with the State agricultural experiment stations established a number of projects in key areas.

One of these projects was established at Blacksburg, Va., in 1938 and 1939. This project is located in the Ridges and Valleys physiographic province which includes parts of Pennsylvania, Maryland, West Virginia, North Carolina, Tennessee, Georgia, and Alabama. The Limestone Valleys and Upland Sections are a part of this same area. Figure 1 shows in detail the general area of application in Virginia.

Organizations and technicians charged with the design of conservation and water-control structures require two primary types of hydrologic data. The first of these is a reliable appraisal of peak rates of runoff that may be expected from watersheds of various sizes under different soil, tillage, and cover conditions. Such data make possible the safe and economical design of structures such as culverts, terrace outlets, farm-pond flood spillways, diversion ditches, and other water-control structures. The peak rates of runoff for several expectancies must be determined in order that the most economical structure may be designed. The second type of data needed is expected water yield from various land sources. These data together with evaporation, seepage, and related data are essential in the planning of farm ponds, drainage installations, supplementary irrigation, and other soil and water-conservation practices.

This publication deals with the rates of runoff only.

That there is a definite relationship between rainfall and runoff has never been satisfactorily borne out by analysis. Because of this the expectancies of runoff rates must, at the present time, be determined directly from the records of runoff. When this approach is used the final estimate is definitely a function of the length of records. While it is realized that the short records now available for such analyses can hardly be considered sufficient, the urgent need for this hydrologic information makes it imperative to derive the best possible estimate from the material at hand.

It was possible to derive an estimate of the relationship between peak rates of runoff and the size of the drainage area. This estimate makes it possible to apply the data to areas not actually gaged. Similar estimates of the effect of physiographic and soil differences upon rates of runoff were made.

Despite the limitations of the data, it is felt that the final curves setting forth expected peak rates of runoff will constitute adequate guides for design work. These curves should be used, however, strictly in accordance with the instructions set forth in this publication

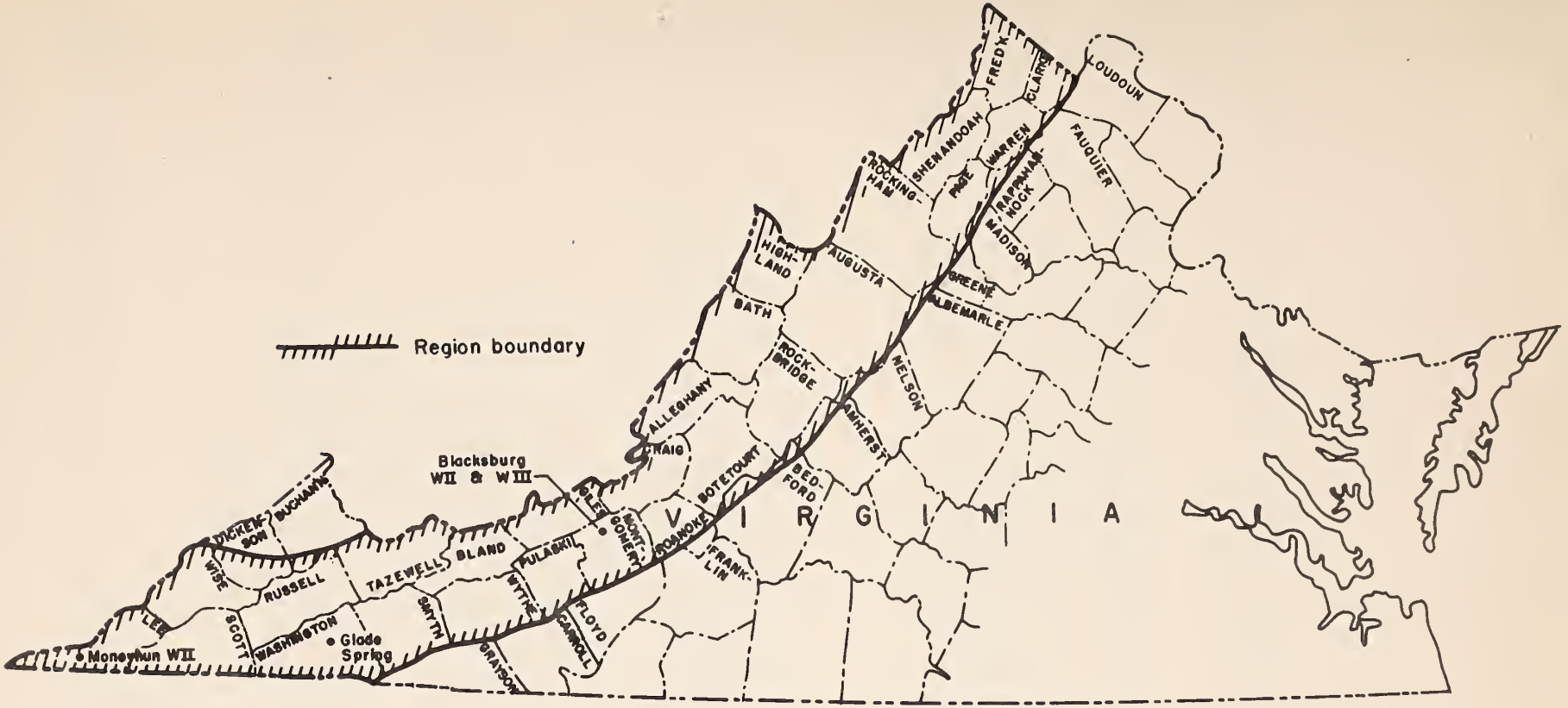


Figure 1.– Extent of the Ridges and Valleys Region in Virginia.

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and should not, under any circumstances, be extended to apply to larger areas than those specified.

Finally, it should be borne in mind that the peak rates of runoff given in this publication are not established values but are the best estimates that could be made from the meager data now available. For this reason they should be considered tentative and subject to revision as additional information becomes available.

## SOURCES OF DATA

The data used in the preparation of this publication were obtained primarily from studies conducted by the Soil Conservation Service and the Virginia Agricultural Experiment Station. The records from these studies include:

a. Runoff, rainfall, temperature, relative humidity, and cover and tillage records for 7 years (1939-45) for two watersheds located 1 mile southwest of Blacksburg, Va. These two watersheds are 5.44 and 19.3 acres in size. Cropping practices are described on the following pages.

b. Runoff, rainfall, and cover records from the following pasture watersheds:

   1. Washington County, Glade Spring, 13.96 acres, 5-year record (1939-43).

   2. Lee County, (Moneyhun), W-II, 6.08 acres, 3-year record (1942-44).

Peak rates of runoff data from three mixed-cover watersheds on the United States Forest Service Bent Creek Project, Asheville, N. C., (No. 3--10.78 acres; No. 8--16.25 acres; and No. 4--773.95 acres) were used for checking the validity of the size-area relations developed from the Blacksburg data. Supplementary data from five additional pasture watersheds in southwest Virginia were reviewed and studied and also runoff records from fifteen 1/50-acre plots at Blacksburg, Va. Additional meteorological records from the station headquarters, such as air temperature, relative humidity, wind velocity and direction, and evaporation, were also studied.

## WATERSHED CHARACTERISTICS

The two Blacksburg watersheds, W-II and W-III, are adjacent to each other in a single field on the Virginia Polytechnic Institute Farm. The installation of these stations was started in 1938. Although some records were obtained in that year, the records used in this study cover only the period of 1939-45. During the first 4 years of the study the watersheds were farmed in a 3-year field rotation of corn, wheat, and clover, and all tillage operations were carried out up and down hill. Since 1943, the watersheds have been contour-strip-cropped, each of the three crops being grown each year.

The pasture watershed data were derived chiefly from two areas in southwest Virginia under the supervision of the Virginia Agricultural Experiment Station. Lee County Watershed W-II was located on the Moneyhun farm $1\frac{1}{2}$ miles east of Jonesville, Lee County, on Highway 58. This watershed was first gaged in 1940. Pasture runoff records were obtained from 1943 until 1944 when measurements were discontinued. The Glade Spring

watershed was located on the Allison farm 1½ miles north of the Glade Spring State Agricultural Experiment Station on Highway 91. Records of pasture runoff were maintained from 1939 until it closed at the end of 1943.

The basic characteristics of these watersheds are outlined in table 1. Discussion of these characteristics will be found in the Appendix. Each of these watersheds is repreentative of the general soil and topographic conditions met with throughout the Ridges and Valleys region.

The cropping practices as carried out on the Blacksburg watersheds were in accord with the common farming methods of the area.

## INSTRUMENTATION AND COLLECTION OF DATA

The instrumentation of the Blacksburg watersheds includes two runoff measuring stations and one rainfall station (pl. 1) located at the junction of the two watersheds.

From 1938 through 1944 the rainfall measuring station consisted of a Friez recording reconnaissance-type rain gage and a standard Weather Bureau gage. The recorder was geared to make one revolution each 6 hours, permitting time to be read to the nearest minute. The sensitivity of the gage permitted reading the rainfall depth to the nearest 0.01 inch. In 1944 this gage was replaced by a Friez rain and snow gage (9-inch capacity) equipped with 6-hour gears and also readable to the nearest 0.01 inch.

During the winter months (Oct. 31 until Apr. 1) this gage was discontinued and all winter records were taken from the R-5 gage on the control plots 1,200 feet east. The general nature of the winter storms makes this procedure justifiable.

The runoff station on the W-II watershed consists of a precalibrated 3-foot H-type flume equipped with a sloping floor to prevent sediment deposition at the stilling-well intake and an automatic water-level recorder housed in an instrument shelter (pls. 2 and 3).

From 1938 until May 1940 the W-III runoff station consisted of a 3-foot H-type flume similar to that on W-II. Because of insufficient capacity this flume was replaced by a concrete broad-crested triangular weir. The side slopes of this weir are 2:1. A 15-foot paved approach channel was constructed above the notch (pls. 4 and 5).

Through use of hydraulic-laboratory calibrations[1/] and pondage correction tables, records of stage were converted to records of runoff. The pondage correction[2/] adjusts for the ponding that is created by the gaging station.

1/HARROLD, L. L., and KRIMGOLD, D. B. Devices for Measuring Rates and Amounts of Runoff, Employed in Soil Conservation Research. U. S. Dept. Agr., SCS-TP-51, illus. July 1943. [Processed.]

2/KRIMGOLD, D. B., and WEBER, J. L. Pondage Corrections Involved in Measuring Surface Runoff from Small Drainage Basins. U. S. Dept. Agr., Soil Conserv. Serv., 42 pp. illus. November 1939. [Mimeographed.]

TABLE 1.--*Physical characteristics of the principal experimental watersheds*

| Characteristics | Blacksburg W-11 | Blacksburg W-111 | Lee Co. W-11 | Glade Spring |
|---|---|---|---|---|
| Size | | | | |
| (Acres) | 5.44 | 19.3 | 6.08 | 13.96 |
| (Square Miles) | .0085 | .032 | .0095 | .022 |
| Prevailing land slope (Percent) | 6, 10 | 3, 5, 13 | No record | No record |
| Range in land slope (Percent) | 1 to 24 | 1 to 20 | No record | No record |
| Length of principal waterway (Feet) | 600 | 1,400 | No record | No record |
| Average slope of principal waterway (Percent) | 6 | 4.6 | No record | No record |
| Drainage density[1] (Feet per acre) | 110 | 73 | No record | No record |
| Form factor[2] (Area/length$^2$) | .29 | .50 | No record | No record |
| Area (Acres) | | | | |
| Cropland | 5.44 | 17.4 | - | - |
| Woods | 0 | .4 | - | Sparse |
| Pasture | 0 | 1.5 | 6.08 | 13.96 |
| Predominant soil type | Dunmore silt loam | Dunmore silt loam | Fullerton cherty silt loam | Westmoreland silt loam |

[1]Drainage density is the length of waterways per acre.
[2]Form factor is the ratio of the width of a watershed to the length and is determined by dividing the area (sq. ft.) by the square of the length (ft.)

PLATE 1.--Rainfall measuring station (R-3) on Blacksburg watersheds. Chart box at left, Friez recording rain and snow gage in center, and a nonrecording standard U. S. Weather Bureau rain gage on right.

PLATE 2.--Blacksburg W-II watershed with 3-foot sloping-floor H-type flume and water-level recorder in foreground. Area 5.44 acres. Predominant soil type is Dunmore silt loam.

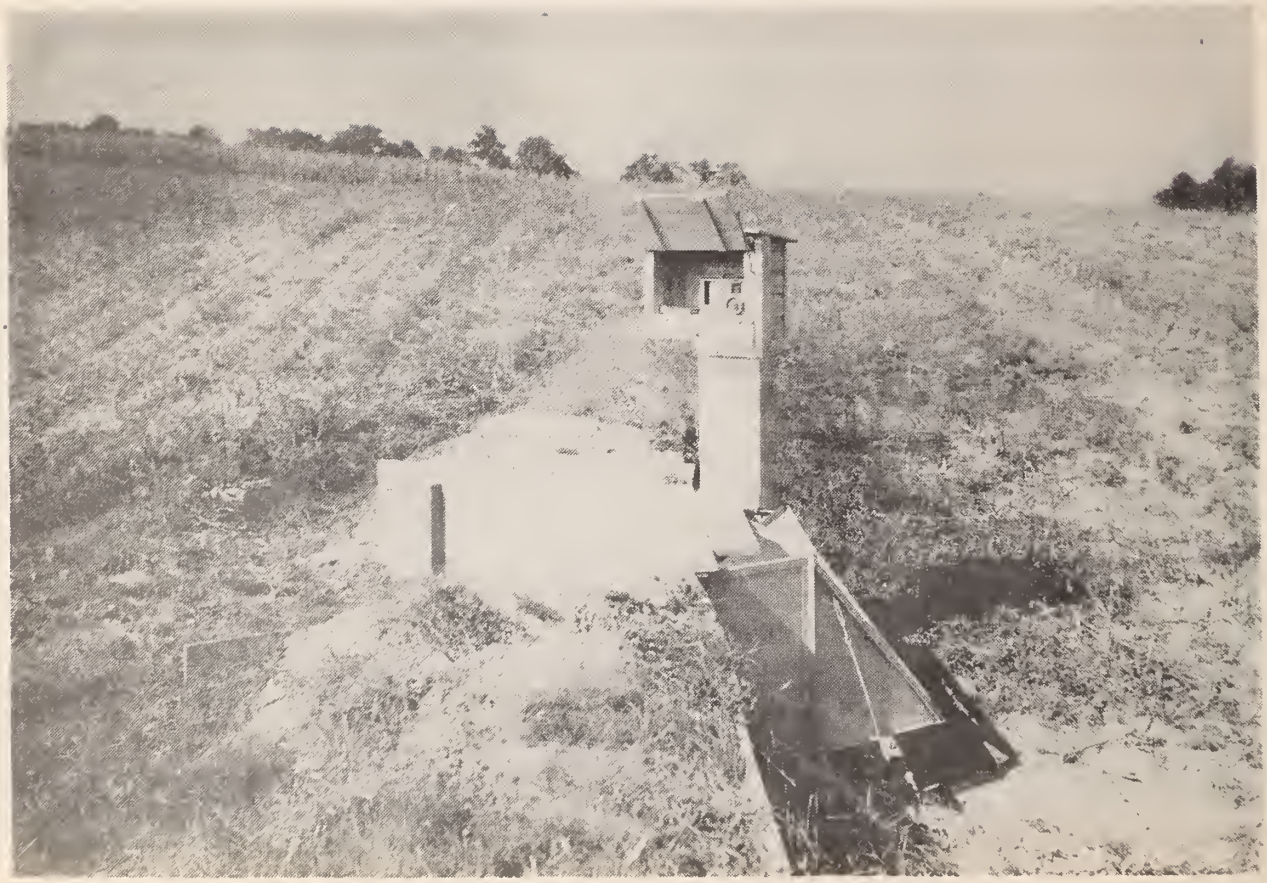

PLATE 3.--Closeup of flume, shelter, and recorder on Blacksburg W-II watershed. This photograph was taken during the period of up and down hill cultivation.

PLATE 4.--Blacksburg W-III triangular broad-crested weir with 2:1 side slopes and 15-foot paved approach channel. Water-level recorder in shelter on right. View downstream.

PLATE 5.--Blacksburg W-III gaging station viewed from downstream side.

Continuous records of rainfall and runoff are obtained through the use of these recording installations. The chart records are converted to tabular records of runoff and precipitation in accordance with standard procedures.3/

Rainfall records on all pasture watersheds were obtained with similar equipment. Runoff from these watersheds was measured with 3-foot, H-type flumes similar to that used on Blacksburg W-II (pls. 6 and 7).

Each of these stations are serviced once at the first of each week and inspected again later in the week. Charts are also changed following each storm period. At the time of servicing the gages the observer records all changes in cover and tillage conditions and other factors occurring on the watersheds.

## ANALYSIS OF DATA

The methods of analysis used in this publication were based on procedures developed in similar reports.4/ The steps followed are briefly outlined below:

The following comparisons were made between the precipitation recorded on each watershed and long time records for the same locality:

1. The total number of excessive storms for various duration periods were compared with 30-year averages developed by Yarnell.5/

2. Amounts of rainfall that occurred during the critical runoff periods (June, July, and Aug.) were compared with similar values derived from the 52-year Weather Bureau record for Blacksburg.

3. The magnitude of rainfall intensity that could be expected to occur on an average of once in 5, 10, and 25 years, was compared with similar values developed by Yarnell5/ from long time Weather Bureau records.

All of these comparisons indicated that the rainfall during the period of record is characteristic of what can be expected over a longer period.

3/KRIMGOLD, D. B. Technical Memo. RS No. 94. U. S. Dept. Agr., Soil Conserv. Serv. June 1940.

4/KRIMGOLD, D. B., and MINSHALL, N. E. Hydrologic Design of Farm Ponds and Rates of Runoff for Design of Conservation Structures in the Claypan Prairies. U. S. Dept. Agr., SCS-TP-56, 22 pp., illus. 1945. [Processed.] , and HOBBS, H. W. Rates of Runoff in the Coastal Plains of New Jersey, Delaware and Maryland. U. S. Dept. Agr., SCS-TP-60, 60 pp., illus. 1945. [Processed.]

5/YARNELL, D. L. Rainfall Intensity-Frequency Data. U. S. Dept. Agr. Misc. Pub. 204, 67 pp., illus. 1935.

PLATE 6.--Lee County W-II watershed. A pasture cover on Fullerton cherty silt loam predominating. 3-foot H-type flume and water-level-recorder shelter in foreground. Watershed area is 6.08 acres. Photograph taken after station was abandoned.

PLATE 7.--Glade Spring watershed, Washington County. Permanent pasture cover on a Westmoreland silt loam. Photograph taken from site of gaging station. Watershed area 13.96 acres.

By extending probability curves developed from the peak rates of runoff recorded during the period of record, peak-rate values for 5-, 10-, and 25-year frequencies were established for the actual watershed areas gaged. The relationship between a rate of runoff and watershed size was then established. This relationship was then used to extend the peak-rate values to cover areas as large as 1,000 acres under certain cover conditions. Runoff data from three United States Forest Service watersheds located near Asheville, N. C., were subjected to identical methods of analysis and it was found that the size relationships developed for both areas checked closely.

When all of the above steps had been reviewed and checked, final design curves were plotted giving the peak rates of runoff for various acreages based on a 10-year frequency. Conversion coefficients were developed to convert the 10-year frequencies to 25-year frequencies.

## RATES OF RUNOFF FOR USE IN DESIGN

Four design curves have been developed for the Ridges and Valleys province. These curves cover straight-row-crop conditions, contour-strip cropping, mixed cover, and pasture cover. A woodland conversion figure is indicated on the pasture curve.

The curves in figures 2, 3, 4, and 5 were developed on a basis of 10-year expectancies. That is, over an extended period of time the indicated rates of runoff may, on the average, be expected to be equaled or exceeded once in 10 years. It does not mean that they will occur during every 10-year period or that they will not occur more than once during any set 10-year period. In most designs, particularly for small areas, 10-year expectancies are entirely adequate.

For large areas or for structures in particularly critical locations or for structures whose costs do not increase rapidly with increase in size, it may be found advisable to use design rates of flow that may be expected to be equaled or exceeded only once in 25 years. Such rates may be determined by use of the coefficient supplied with each graph.

In preparing these curves, a number of practical problems had to be taken into consideration. Changes in farm ownership and management might conceivably change the land-use pattern on areas from that in use at the time a control structure was designed to one contributing to higher rates of runoff. These possible land-use changes were considered in setting up the limitations for use for each of the curves. Hence, pasture areas that are smooth, free from excessive rock outcroppings and stumps, and considered plowable are included under curves for cultivated land. Areas that are steep, rocky, or otherwise unplowable are considered under the pasture curve.

In using the curves the designers should use care in selecting the proper curve to fit the individual area conditions at hand. Cover, soil type, and land capability should all be considered in the curve selection.

### Straight-Row-Crop Curve

The straight-row-crop curve (fig. 2) was developed on the basis of the 1938-42 cropping period which included 2 years of corn and 1 year of wheat (up and down hill drill) and 1 year of clover. This curve should be applied to areas of 50 acres or less that have been straight-row-cropped or that are likely to be straight-row-cropped in the future. It is applicable to moderately deep well-drained soils such as Dunmore, Groseclose, Hagerstown, Frederick, Fullerton, Decatur, Pisgah, Cumberland, or similar soils.

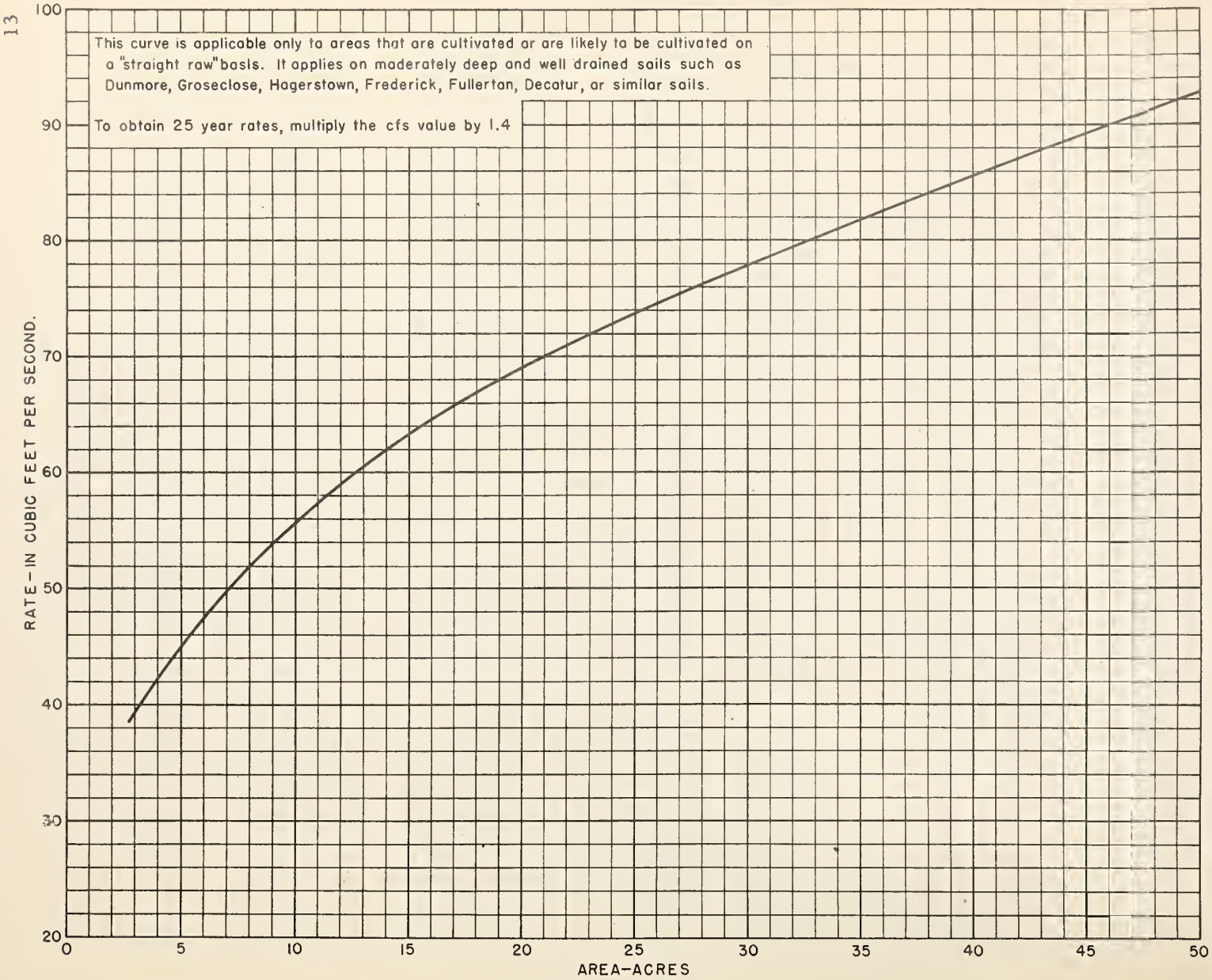


FIGURE 2.—RATES OF RUNOFF THAT MAY BE EXPECTED ONCE IN 10 YEARS UNDER "STRAIGHT ROW" CULTIVATION.

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## Contour-Strip-Crop Curve

The contour-strip-crop curve (fig. 3) was developed on a basis of the 3 years of contour-strip-cropping data (1943-45). It is applicable where 3- or 4-year rotations of corn, small grain, and hay have been planted and cultivated in contour strips. It may be used with the same soil types listed for straight-row crops.

Because of the limited extent of the data from which this curve is derived, extension beyond 60 acres is not warranted. Field requests indicate, however, a need for information covering up to 100 acres. A dotted line represents these extended data. It is not probable, however, that many single drainage areas will exceed the 60-acre size in the Ridges and Valleys of Virginia.

## Mixed Cover

The mixed-cover curve (fig. 4) was developed from the whole 7-year Blacksburg record which includes both contour and up and down hill cultivation. It is applicable to areas having a 3- or 4-year rotation of corn, small grain, and hay or equivalent; that is, one-third pasture or woodland, one-third or more small grain, and not more than one-third row crops. A solid-line curve is supplied for areas up to 500 acres and a dotted-line curve for areas from 500 to 1,000 acres.

## Pasture Land

The pasture curve (fig. 5) is based on a 3-year record from an area that had not received adequate care in grazing and fertilizing. While records show that on well-treated and carefully grazed pastureland runoff rates are lower, it was deemed advisable to use the higher rates from the less-cared-for areas.

This pasture curve may be used for areas of the same soils listed for straight-row cropping and is extended to cover areas up to 1,000 acres. Special provisions for the application of this curve to certain wooded or wooded-pasture areas are noted on the pasture curve and in the following section.

## Woodland

No definite runoff data are available from the small wooded watersheds in the Virginia Ridges and Valleys. Since the major part of the watersheds that are totally in woods in this physiographic province are in the cap rock and sandstone areas, data from the upland soils cannot be easily adapted for use on wooded areas occurring in lower areas. However, rates of runoff from the Glade Spring watershed in Washington County, an area that is partially wooded and has in addition a draw with a deep absorptive soil, were considerably lower. This would indicate that still lower rates of runoff may be expected from areas entirely in woods.

It must be clearly understood that grazed woodland should not be considered as having a runoff rate differing from that of pasture land. Burned-over woodland must be considered, for design purposes, as having an even higher runoff potential than pasture land. Only wooded areas having an adequate ground cover of forest litter would show the lower runoff rates.

On the basis of these considerations, it is suggested that the pasture curve be used on areas including up to 50 percent woods or wooded pasture. On ungrazed wooded areas comprising more than 50 percent of the watershed and having a good deep litter cover, the pasture curve-values may be reduced by one-half.

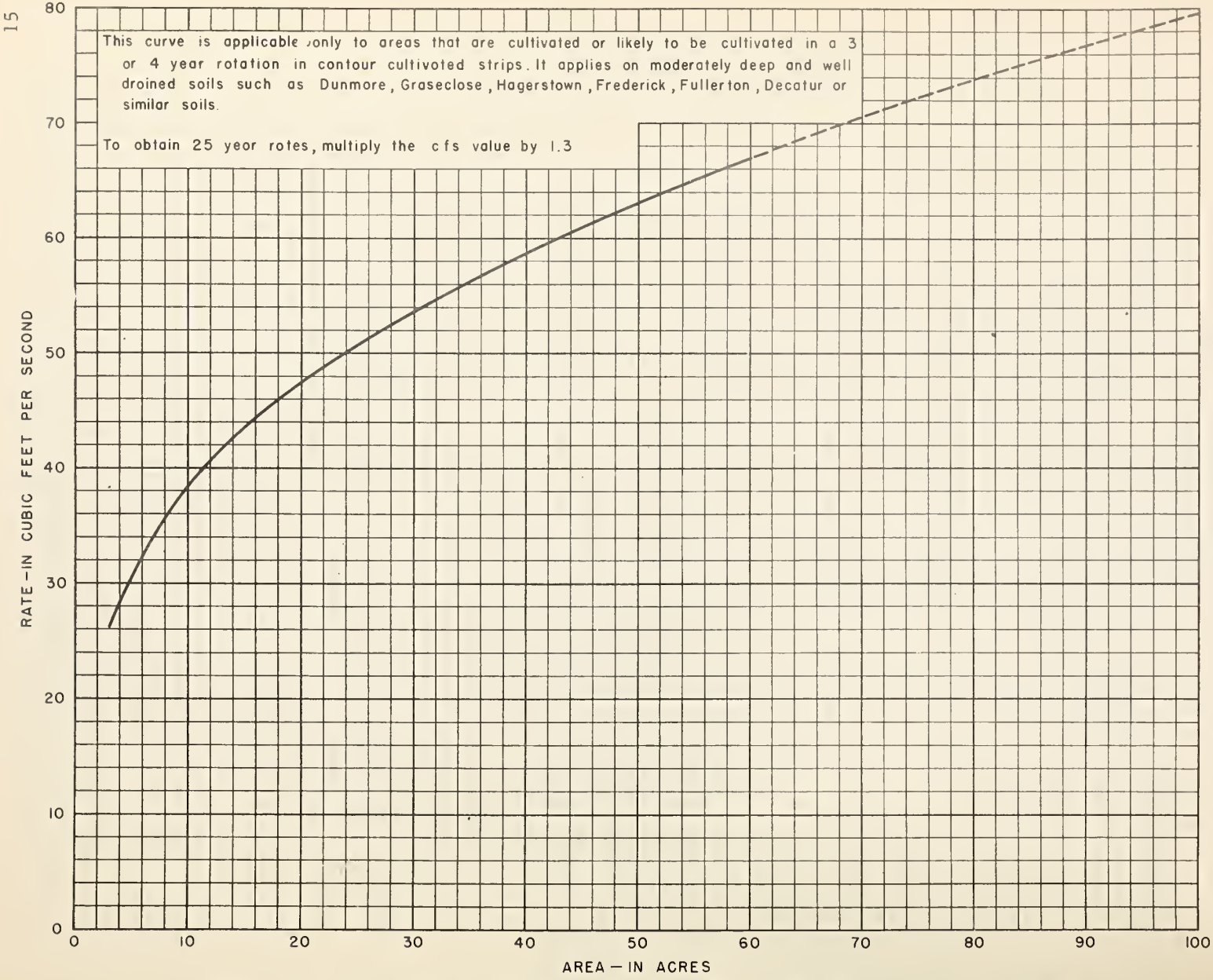


FIGURE 3.—RATES OF RUNOFF THAT MAY BE EXPECTED ONCE IN 10 YEARS UNDER CONTOUR CULTIVATION

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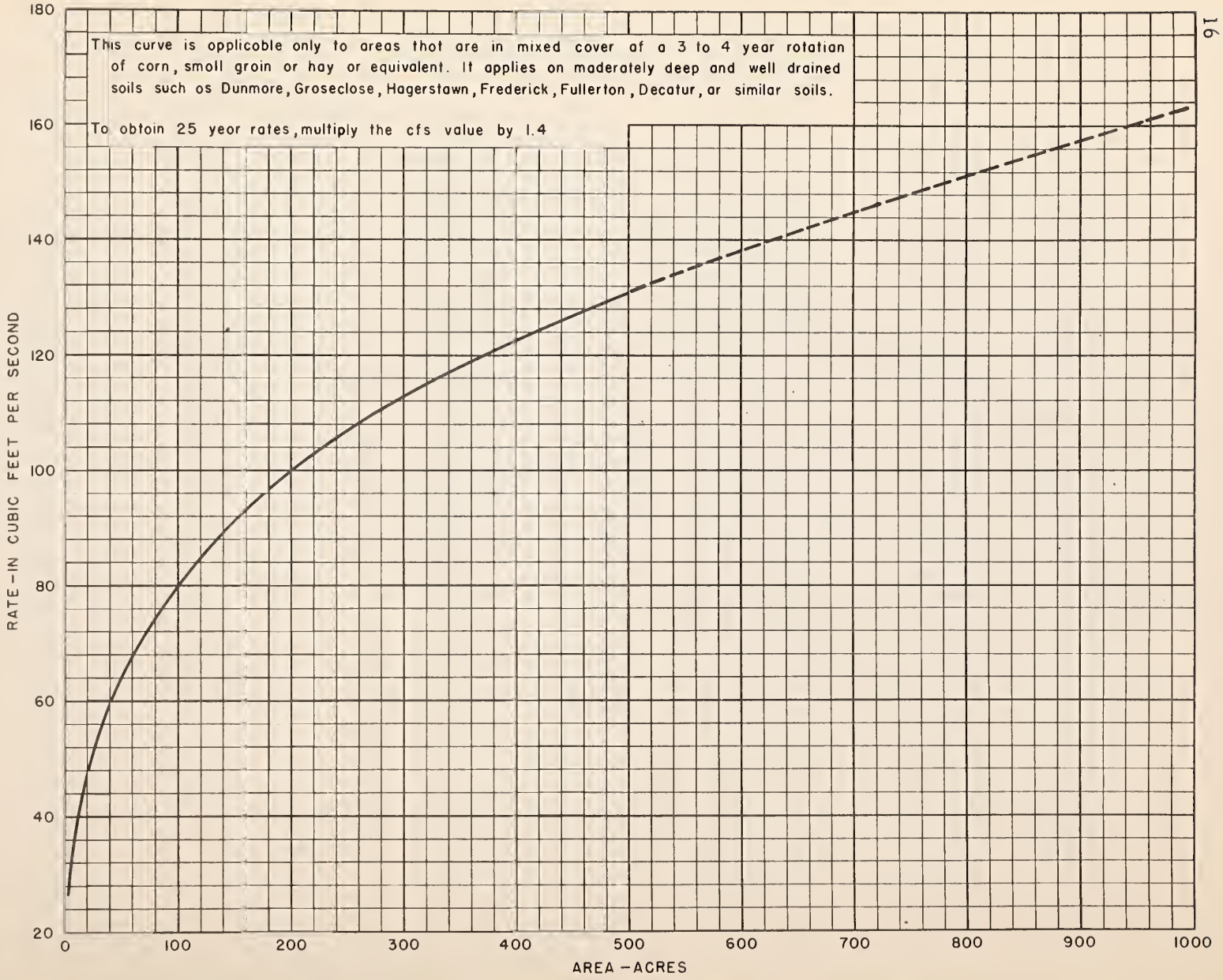


FIGURE 4.- RATES OF RUNOFF THAT MAY BE EXPECTED ONCE IN 10 YEARS UNDER MIXED COVER.

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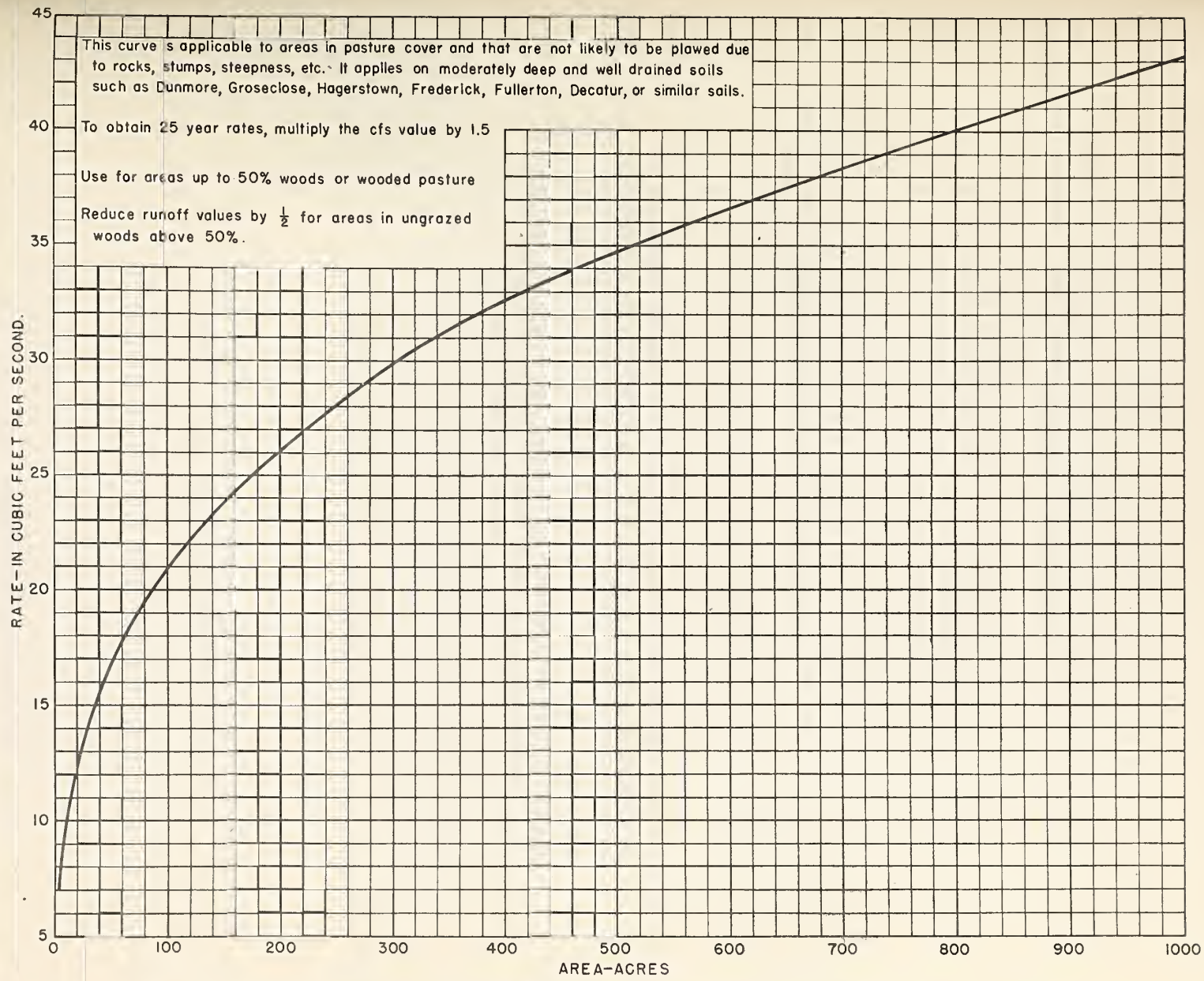


FIGURE 5.—RATES OF RUNOFF THAT MAY BE EXPECTED ONCE IN 10 YEARS UNDER PERMANENT PASTURE.

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I.S.D. 5503

## Example

There are certain routine steps that should be taken in using these data in design work.

First it is necessary to collect and analyze all of the factors affecting the design, that is:

1. Total acreage of drainage area, correct within 10 percent.
2. Information about the land.
3. Acreage breakdown by existing cover, tillage, and soil type.

When these data have been assembled, select the curve that most adequately covers those conditions. On this curve find the peak-runoff rate that may be expected. This rate is expressed in terms of cubic feet per second. With this figure at hand turn to handbooks or to prepared tables and find the cross-sectional area or other dimensions necessary for the proper structure.

Following is a typical design problem worked out in detail.

PROBLEM: On a valley farm a moderately large field of Class II land lies directly below a 40-acre tract of moderately steep, permeable, moderately deep silt loams that because of the slope are in Class IV, suited for limited cultivation. In planning the farm both of these fields will have to be cropped. To give maximum protection to the Class II land it is decided to construct a diversion channel between the two areas to carry runoff from the upper field into a nearby wood. What size channel should be constructed to safely accomplish this purpose?

SOLUTION:

A. Pertinent Data

1. Total area above Class II land--40 acres.

2. Soils--Moderately deep silt loams, moderately permeable subsoils. Groseclose, Dunmore, and Emory soils.

3. Present land use--35 acres in 3-year corn-wheat-clover field rotation, 5 acres in mixed woodland.

4. Proposed land use--Strip cropped with alternating corn, wheat, and clover strips on the 35 acres of cultivated land.

B. Considerations

1. Although strip cropping is proposed, this field might revert to field cropping should ownership change--maximum cultivation is the criterion.

2. The woodland area because of its relatively small extent should be included as part of the cultivated area for simplicity of design.

3. A 10-year expectancy is adequate since the failure of the structure would not cause such damage as to justify the cost of a larger diversion.

C. Design

1. Figure 2, page 13, contains the data applicable to the cover, soil, and area conditions at hand.

   a. Locate 40 acres on the horizontal scale. and find its intersection with the curve. This point read on the vertical scale (85.5) gives the number of cubic feet per second for which the diversion should be designed.

2. Using this figure, determine the final cross-section dimensions from special handbooks or tables of design.

It is beyond the scope of this publication to cover in detail the actual mechanics of the design of such items as diversions, spillways, culverts, and other water-control structures. For that reason, attention is called to a number of publications listed in Selected References, page 20, that have been issued by the Soil Conservation Service and other agencies which contain information on the design of such structures.

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# APPENDIX

The soil profiles shown in figure 6 and described in table 3 and the topographic map (fig. 7) give a complete picture of the watershed terrain features.

The cropping and tillage history is outlined more fully in table 2. The two Blacksburg watersheds are cropped under the direction of the Virginia Polytechnic Institute Dairy Husbandry Department. During the first 4 years of the study the fields were under a 3-year (corn, wheat, clover) field rotation with straight-row (up and down hill) farming practices. In 1943 this cropping system was changed to a strip-cropping pattern utilizing a 4-year rotation of corn (cover crop), corn, wheat, and clover. The contour cultivation eliminated the up and down hill rows that had previously deposited silt in the watershed channels.

The common practice in this area is to plow clover sods in January or February. After a thorough disking in late April, corn is planted early in May. It is usually fertilized at a rate of 300 pounds of 4-12-4 per acre. During most seasons three cultivations are made, the last not later than July 15. Silage corn is usually harvested between August 25 and September 1 and in a normal season field corn is cut about September 20. The stubble is then disked, and about October 10 small grain is drilled. The grass seed is usually broadcast at the same time and the clover seed during the following March or April. The subsequent small-grain crop is harvested the following June. The clover and grass growth is frequently mowed that same fall. One heavy cutting of hay is taken off the area the third year and the second growth allowed to stand for a green-manure crop.

The dominant soil on the W-II and W-III Blacksburg watersheds is Dunmore. The characteristics of this soil are outlined in figure 6 and table 3. It is fortunate that the Dunmore soils have smiliar hydrologic characteristics to a large group of the more important agricultural soils in the Ridges and Valleys region. This group includes soils of the Groseclose, Frederick, Hagerstown, Pisgah, Decatur, Cumberland, and Fullerton series. Fullerton soils occur in the Lee County W-II watershed.

There is a second important group of soils which appear from observation to have hydrologic characteristics that are similar to the soils in the above group. These soils include Lodi, Clarksville, Bolton, Tellico, Muskingum, Allen, Jefferson, and Hayter soils. They are moderately light texture, well-drained, and highly absorptive soils. The fact that there have been no watershed studies carried out on any of the soils in this group makes it impossible to prepare definite curves to fit them. It is suggested, however, that this group of soils may be tentatively included in the first group until such time as further watershed studies can be carried out on some one of these soil types.

A third group includes the shallow light-textured and erodible soils of which little is known in regard to their hydrologic characteristics. Although the Glade Spring pasture watershed has a soil representative of this group there are not sufficient data upon which to prepare valid curves covering them. Soils in this group include Westmoreland, Litz, Berks, Dandridge, and Teas series and also the Burgin, Carbo, Chilhowie, Bland, Colbert, and Montevallo series. With the exception of Montevallo these soils have moderately absorptive A horizons but are underlain with a tight heavy subsoil of low permeability. The Montevallo is a very shallow soil underlain with shale, hence, it has an extremely low absorptive capacity. It is assumed that these soils have a much higher rate of runoff than any of the soils previously discussed.

Adequate design data for such soils will not be forthcoming until new hydrologic research work can be initiated covering such soil conditions. Until such steps can be taken design of hydraulic structures will have to be based upon experienced judgment. The data

TABLE 2.--*Blacksburg watershed cropping practices*

| Year | Crop | W-II[1] | Acreage | W-III[2] |
|---|---|---|---|---|
| | | *Acres* | | *Acres* |
| 1939 | Corn | 5.44 | | [3]17.1 |
| 1940 | Wheat | 5.44 | | 17.1 |
| 1941 | Clover | 5.44 | | 17.1 |
| 1942 | Corn | 5.44 | | 17.1 |
| 1943[4] | Corn | 2.43 | | 9.93 |
| | Misc. small grain | 3.01 | | 7.17 |
| | Clover | - | | - |
| 1944 | Corn | 2.49 | | 7.73 |
| | Wheat | 1.58 | | 4.46 |
| | Clover | 1.37 | | 5.21 |
| 1945 | Corn | 2.72 | | 10.20 |
| | Wheat | 1.14 | | 2.44 |
| | Clover | 1.58 | | 4.46 |

[1]Total area = 5.44 acres.
[2]Total area = 19.3 acres.
[3]Balance in woodland and pasture
[4]Strip cropping estimated in 1943.

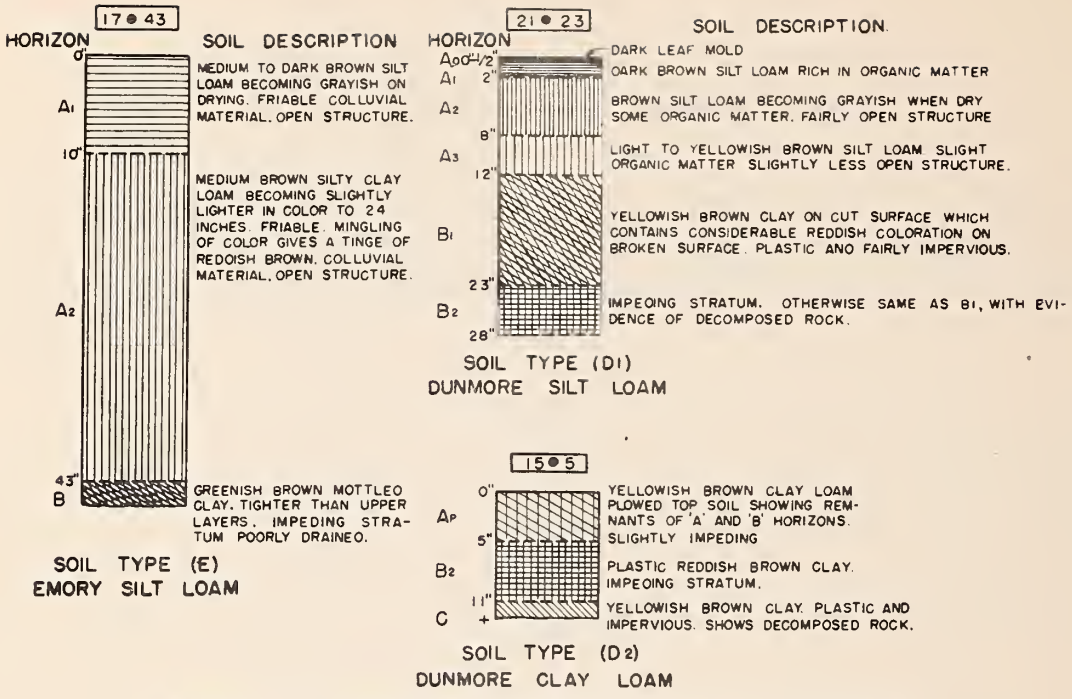
17 • 43
HORIZON
SOIL DESCRIPTION
0"
A1
MEDIUM TO DARK BROWN SILT LOAM BECOMING GRAYISH ON DRYING. FRIABLE COLLUVIAL MATERIAL. OPEN STRUCTURE.
10"
A2
MEDIUM BROWN SILTY CLAY LOAM BECOMING SLIGHTLY LIGHTER IN COLOR TO 24 INCHES. FRIABLE. MINGLING OF COLOR GIVES A TINGE OF REDDISH BROWN. COLLUVIAL MATERIAL. OPEN STRUCTURE.
43"
B
GREENISH BROWN MOTTLED CLAY. TIGHTER THAN UPPER LAYERS. IMPEDING STRATUM POORLY DRAINED.
SOIL TYPE (E)
EMORY SILT LOAM
21 • 23
HORIZON
SOIL DESCRIPTION
A00-1/2"
DARK LEAF MOLD
A1 2"
DARK BROWN SILT LOAM RICH IN ORGANIC MATTER
A2
BROWN SILT LOAM BECOMING GRAYISH WHEN DRY SOME ORGANIC MATTER. FAIRLY OPEN STRUCTURE
8"
A3
LIGHT TO YELLOWISH BROWN SILT LOAM SLIGHT ORGANIC MATTER SLIGHTLY LESS OPEN STRUCTURE.
12"
B1
YELLOWISH BROWN CLAY ON CUT SURFACE WHICH CONTAINS CONSIDERABLE REDDISH COLORATION ON BROKEN SURFACE. PLASTIC AND FAIRLY IMPERVIOUS.
23"
B2
IMPEDING STRATUM. OTHERWISE SAME AS B1, WITH EVIDENCE OF DECOMPOSED ROCK.
28"
SOIL TYPE (D1)
DUNMORE SILT LOAM
15 • 5
0"
AP
YELLOWISH BROWN CLAY LOAM PLOWED TOP SOIL SHOWING REMNANTS OF 'A' AND 'B' HORIZONS. SLIGHTLY IMPEDING
5"
B2
PLASTIC REDDISH BROWN CLAY. IMPEDING STRATUM.
11"
C +
YELLOWISH BROWN CLAY. PLASTIC AND IMPERVIOUS. SHOWS DECOMPOSED ROCK.
SOIL TYPE (D2)
DUNMORE CLAY LOAM

Figure 6. Sectional description of soil profiles on Blacksburg watersheds - W-II and W-III.

| SOIL CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| SYMBOL | TYPE | ACRES | | % OF AREA | | DESCRIPTION |
| | | W-II | W-III | W-II | W-III | |
| E | EMORY SILT LOAM | 0.3 | 1.20 | 5.5 | 6.2 | SEE SOIL TYPE COLUMN DIAGRAM OF TYPICAL PROFILE. NO SOIL HAS BEEN REMOVED BY EROSION. HAS A SILT LOAM TEXTURE AND IS COLLUVIAL SOIL. |
| D1 | DUNMORE SILT LOAM | 5.14 | 17.3 | 94.5 | 89.65 | SEE SOIL TYPE COLUMN DIAGRAM OF TYPICAL PROFILE. IN AREA CONTAINING SYMBOL D1-1, NO EROSION OF SURFACE: VIRGIN TIMBER. IN AREA CONTAINING SYMBOL D1-2, LESS THAN 25% OF SURFACE SOIL REMOVED BY EROSION. HAS SILT LOAM TEXTURE. IN AREA CONTAINING SYMBOL D1-3, 25% TO 75% OF SURFACE SOIL HAS BEEN REMOVED BY EROSION. HAS A SILT LOAM TEXTURE. |
| D2 | DUNMORE CLAY LOAM | — | 0.8 | — | 4.15 | IN AREA CONTAINING SYMBOL D2-4, OVER 75% OF SURFACE SOIL HAS BEEN REMOVED BY EROSION. HAS A CLAY LOAM TEXTURE. |
| | TOTAL | 5.44 | 19.3 | 100 | 100 | |

Table 3. Soil Characteristics on Blacksburg, Virginia, watersheds - W-II and W-III.

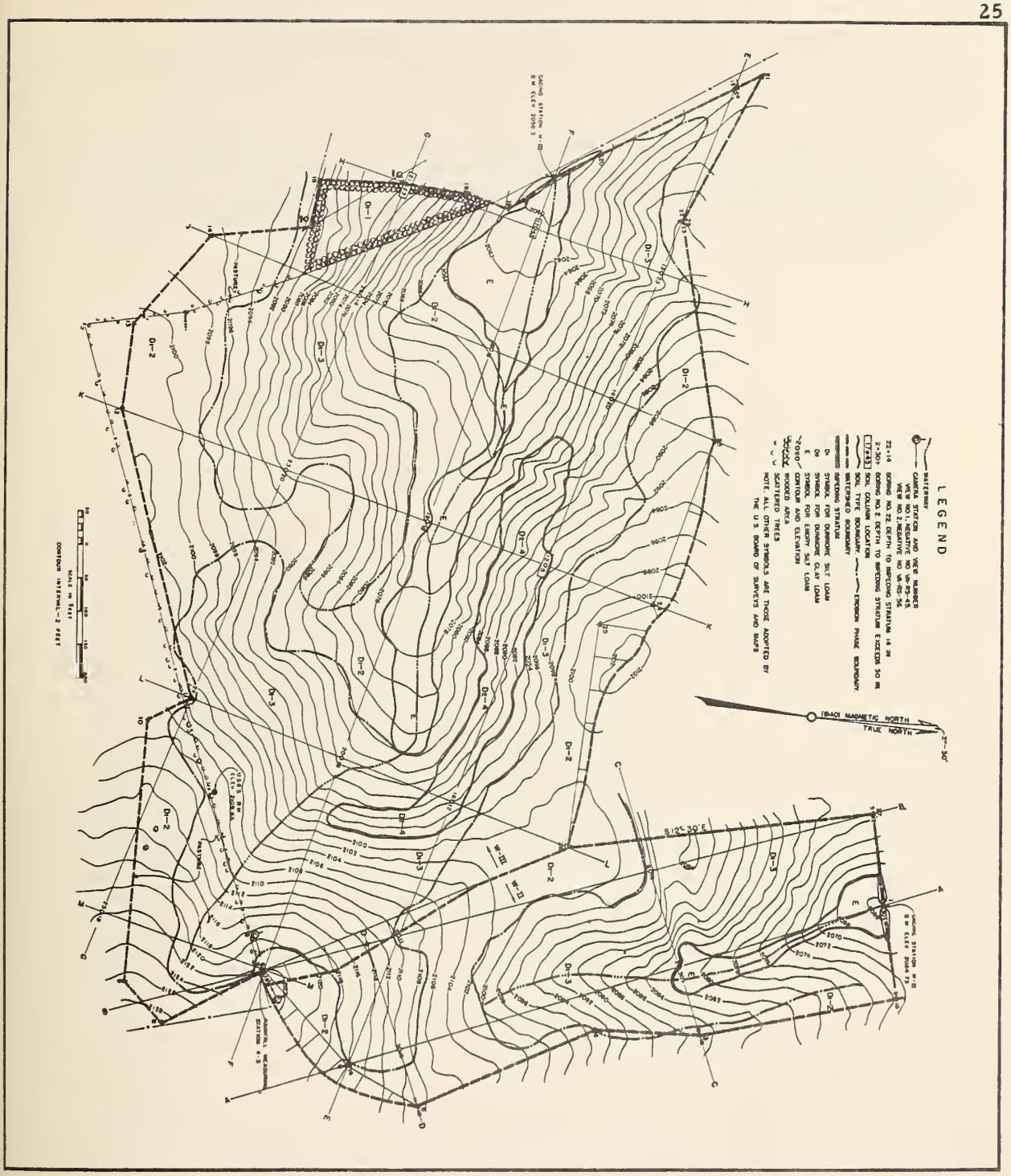


Figure 7. Map of permanent features of the Blacksburg, Virginia, watershed areas.

presented in this publication, may, when properly interpreted, serve as a guide to such judgment.

The topographic, cover, and tillage characteristics of all of the watersheds used in preparing this publication are highly representative of the characteristics found throughout the Ridges and Valleys of Virginia and the other States. Physiographic factors, such as slope, watershed size, and watershed conformation are in accord with those found throughout the area.